UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/902,859	07/11/2001	Evangelos Stavros Eleftheriou	CH920010036US1	1679

		EXAMINER
7590	05/12/2004	CHASE, SHELLY A

IBM CORPORATION
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ART UNIT	PAPER NUMBER
2133	

DATE MAILED: 05/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 February 2004*.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All   b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

1.   Claims 1 to 14 are presented for examination.

Response to Amendment

2.   The office action is in response to applicant amendment filed 2-23-2004.

3.   The objection to the specification is **withdrawn**.

4.   The rejection of claims 1 to 14 under 35 USC 103(a) as being obvious over Bond

et al. in view of Richardson is **withdrawn**.

5.   Applicant's arguments with respect to claims 1 to 14 have been considered but

are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 102

6.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that

form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

7.   Claims **1, 4** to **5, 8** and **13** are rejected under 35 U.S.C. 102(a) as being

anticipated by Richardson et al..

Claims **1, 5** and **13**:

Richardson teaches efficient encoding of low-density parity check codes

(LDPCC) wherein a parity check matrix H is defined by mXn (see pg 641 par. 1),

("defining a first MxN parity check matrix"). Richardson also teaches that the original

parity check matrix is reduced through permutation to a lower triangular matrix T (see

pg. 641 par. 5), ("second parity check matrix having an MXM triangular sub-matrix").

Richardson further teaches encoding the lower triangular matrix to achieve the

required codeword (see pg 462 to 463), ("mapping the data into LDPC code words

based on the second parity check matrix"). Richardson also teaches that using the

Greedy algorithm to approximate triangulation for efficient encoding (see pg 644 et

seq.). Richardson further teaches the LDPCC are used in message-passing decoders

for a binary-erasure channel (BEC) wherein the LDPCC are transmitted via the

communication channel BEC (see pg. 640 par. 2).

As per claims **4** and **8**, Richardson teaches a diagonal extension step wherein

the kXk sub-matrix has a diagonal form where the known column is permuted to

produce the sub-matrix (see pg. 644 sect. A).

8.   Claims **9, 12** and **14** are rejected under 35 U.S.C. 102(a) as being anticipated by

Zhang et al. (*A class of efficient-encoding generalized low-density parity check codes*,

IEEE).

Claims **9** and **14**:

Zhang teaches a coding system employing LDPCC wherein a hardware/software

encoder includes digital signal processor (DSP) with a register file (see fig. 7) for

encoding LDPC codes, the system comprising: defining a parity check matrix (see pg

2477 sect. 2), generating sub-matrix through an upper triangular form (see pg. 2478

sect. 3) and encoding based on the generated sub-matrix (see pg. 2479 sect. 3.2).

As per claim **12**, Zhang teaches constructing of a matrix set parameters along

the diagonal (see pg. 2478 sect. 3.1).

Claim Rejections - 35 USC § 103

9.   The text of those sections of Title 35, U.S. Code not included in this action can

be found in a prior Office action.

10.   Claims **2** to **3** and **6** to **7** are rejected under 35 U.S.C. 103(a) as being

unpatentable over Richardson et al. in view of Bond et al. (*Low density parity check*

codes based on sparse matrices with no small cycles IMA).

As per claims **2** to **3** and **6** to **7**, Richardson does not specifically teach

eliminating 4 cycles and cyclically shifting rows of the first matrix; however, Bond in an

analogous art teaches a systematic construction of matrices for LDPCC with a

constraint of no 4-cycles (see page 47 par. 2) and constructing a matrix wherein the

data are applied from one row node to another row node (see pg 50).   Therefore, it

would have been obvious to one having ordinary skill in the art at the time the invention

was made to modify generating the matrix of Richardson to include constructing

according to no 4-cycles and shifting from one row node to another row node as taught

by Bond. This modification would have been obvious because a person of ordinary skill

in the art would have been motivated to employ the construction of matrices with 4 cycles for better performance as taught by bond (see pg 53 sect. 3).

11.   Claims **10** to **11** are rejected under 35 U.S.C. 103(a) as being unpatentable over Richardson et al. in view of Bond et al..

As per claims 10 to 11, Zhang does not specifically teach eliminating 4 cycles and cyclically shifting rows of the first matrix; however, Bond in an analogous art teaches a systematic construction of matrices for LDPCC with a constraint of no 4-cycles (see page 47 par. 2) and constructing a matrix wherein the data are applied from one row node to another row node (see pg 50).   Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify generating the matrix of Zhang to include constructing according to no 4-cycles and shifting from one row node to another row node as taught by Bond. This modification would have been obvious because a person of ordinary skill in the art would have been motivated to employ the construction of matrices with 4 cycles for better performance as taught by bond (see pg 53 sect. 3).

Response to Arguments

12.   Applicant's arguments filed 2-23-2004 with respect to claims 1 to 14 have been fully considered but they are not persuasive.

In response to the arguments concerning the previously rejected claims the following comments are made:

In response to the argument on page 9 that Richardson fails to teach generating a second parity check matrix having an MXM triangular sub-matrix, the examiner disagrees with applicant's representative for the following reasons: Richardson teaches efficient encoding for LDPCC wherein a parity check matrix of MxN is identified (see page 641 par. 1), then performing permutation to achieve a lower triangular form of the matrix (see pg. 641 par. 5).   Therefore, the examiner maintains that the prior art made of record substantially teaches the claimed limitation.

As to the argument on page 9 that Richardson does not teach or suggest mapping data into an LDPC code word based on the second matrix, the examiner disagrees because, efficient encoding as taught by Richardson encompasses the parity check matrix in the lower triangular form and the matrix in the lower triangular form was created from the permutation of a MxN parity check matrix (see pg. 641 sect. II). Richardson further teaches constructing LDPC codes that can are encodable within a reasonable time (see pg 638 intro.).

Conclusion

9.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelly A Chase whose telephone number is 703-308-7246. The examiner can normally be reached on Mon-Thur from 8:00 am to 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on 703-305-9595. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

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you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).

Shelly A Chase